

REMARKS

Objected to Claims 6-8

Applicants thank Examiner for the conditional allowance of claims 6-8. Responsive to the Office Action, Applicants have amended claim 6 to include all of the limitations of former claim 1 to which claim 6 formerly depended. As such, Applicants submit that this amendment does not constitute the narrowing of the claimed subject matter for claim 6. Applicants further submit that claims 7 and 8 are now allowable as written as they now depend from allowable claim 6.

Cancelled Claims 1, 9 and 13

Applicants request the cancellation of claims 1, 9 and 13 without prejudice.

Cited References

Rosman et al.

Applicants submit that Rosman et al. initially identifies two pixels that represent the end pixels for a current horizontal scan line, (col. 4, lns. 44-48). It is only after such identification that a raster engine generates pixel colors for the pixels along the span that lie between and including the two end pixels, (col. 48-55). Here, in Rosman et al., the raster engine therefore knows initially that any given pixel located between, and including, the two endpoints, represent pixels that will be displayed. Because Rosman et al. discloses the pre-identification of endpoints of a horizontal line to be displayed there is no reason for successive points along such line to be tested to determine they fall within the corresponding triangle. As such, Rosman et al. teaches away from any need to use edge functions to determine whether each next adjacent pixel will be displayed.

Applicants also submit that as the Rosman et al. span engine first determines the endpoints before such endpoints are received for processing by the raster engine, (col. 4, lns. 44-50), the rendering of the pixel is always performed after a determination is made as to whether any particular pixel is within a triangle. As such, Rosman et al. teaches away from the simultaneous checking of whether a next pixel lies within a display area at the same time that a current pixel is scanned or rendered.

Applicants further submit that Rosman et al. also does not disclose, teach or suggest the use of edge functions to determine whether a next sequential pixel in a span is within or without the graphic primitive. Instead, a span engine first generates the edges of a triangle and the corresponding endpoints that make up the horizontal lines that lie therebetween, (col. 6, lns. 51-60). Once such endpoints are generated, a raster engine generates pixels along a horizontal span within the triangle for only those points between and including the corresponding endpoints (col. 6, lns. 56-57). Therefore, Applicants submit that Rosman et al. in fact teaches away from the use or need of an edge function as the span engine determines the points to be displayed before attempting to display them using the raster engine. Therefore, Applicants submit that neither Rosman et al. alone, nor any of the cited art, either implicitly or explicitly, or when considered alone or in combination, disclose, teach or suggest Applicants' claimed subject matter.

Zhao et al.

Zhao et al. is directed to a block and band-oriented traversal in three-dimensional triangle rendering. Zhao et al. discusses the determining of whether the end of a current span has been reached. (col. 8, lns. 47-53). The end is determined by determining the position of the currently selected pixel in comparison to the demarcation edge of the primitive. (Id.) Here, Zhao et al. is limited to describing the checking of a current pixel and does not discuss the looking ahead to a next pixel. In addition, specifically relating to Zhao et al.'s discussion of block and band-oriented traversals, and as shown in detail in Fig. 13, even though Zhao et al. discusses the rendering of groups of pixels, or blocks of pixels, (i.e., the block defined by the horizontal 15-16 and 7-8, and the vertical 0 and 7-8 boundaries), a similar left to right individual pixel traversal is still contemplated, (col. 10, lns. 43-51), and for at least pixels 3 and 7, (Fig. 13), such pixels are determined as being an end pixel in the same technique described above using a current pixel determination scheme. Here, even though the processing of pixels in blocks is described, the same processing arises, at least, for those occasions where the edge of a triangle ends before the end or edge of a corresponding block. Therefore, whether a block traversal or a span-walking scheme is used, Zhao determines the end of span by determining the position of a currently selected pixel, not a next-look-ahead pixel. As such, Applicants submit that Zhao et al. teaches away from Applicants claimed subject matter as it discloses a current pixel evaluation scheme, rather than a next pixel look ahead process. Therefore, Applicants submit that neither Rosman et

al. or Zhao et al., either implicitly or explicitly, or when considered alone or in combination, disclose, teach or suggest Applicants' claimed subject matter.

Malamy et al.

Malamy et al. is directed to polygon rendering with a dedicated setup engine. More specifically, Malamy et al. discloses a system of rendering polygons using two division operations rather than four. (col. 2, lns. 34-44). Applicants submit that Malamy et al., (Abstract, Fig. 2, Fig. 3, Fig. 4, col 2, lns. 45-54, col 5 lns. 1-5), is absent any reference to Applicants' edge function, as well as being absent any reference to using any look-ahead type functionality to determine whether a next successive pixel will fall outside of a graphic primitive. In contrast, Malamy et al. discloses an edge walker that iterates along the long edge of a triangle determining starting points for successive spans, (col. 3, lns. 45-54). As such, Malamy et al. is not identified as disclosing "edge functions," (claim 3), including, for example, " $E0=(X2-X1)(Y-Y0)-(Y2-Y0)(X-X0)$," " $E1=(Y1-Y0)(X-X0)-(X1-X0)(Y-Y0)$ " and " $E2=(Y2-Y1)(X-X1)-(X2-X1)(Y-Y1)$," (Fig. 3), where such edge functions are used to determine if an x,y coordinates of a given pixel falls within a primitive defined by the corresponding edges, (Spec. pg. 7, lns. 3-6). Therefore, Applicants submit that neither Rosman et al., Zhao et al., nor Malamy et al., either implicitly or explicitly, or when considered alone or in combination, disclose, teach or suggest Applicants' claimed subject matter.

New Claims 17-21

Applicants present new claims 17-21 and accordingly, request a new prior art search. Applicant submits that the new language in the new claims does not include new matter.

Independent Claim 17

Independent claim 17 is a new claim and recites, among other features,

... a scan module that scans only pixels within the graphic primitive and assigns data values to each of the pixels and a look-ahead module that identifies pixels that are inside of the primitive;

wherein the look-ahead module processes successive pixels one at a time using edge functions to determine whether a next pixel is within the graphic primitive; and

wherein the scan module *scans a pixel previously identified as being within the graphic primitive while the look-ahead module processes the next pixel.*

Applicants respectfully reassert the arguments made above regarding Rosman et al., Zhao et al. and Malamy et al., and further submit that, none of the references, either implicitly or explicitly, or whether considered alone, or in combination with any one or more of the other references, disclose, teach or suggest, claim 17's language including, inter alia,

... a scan module that scans only pixels within the graphic primitive ... and a look-ahead module that identifies pixels that are inside of the primitive; wherein the look-ahead module processes successive pixels one at a time using edge functions to determine whether a next pixel is within the graphic primitive; and wherein the scan module scans a pixel previously identified as being within the graphic primitive while the look-ahead module processes the next pixel,

(claim 17), nor do the references disclose, teach or suggest the subject matter of claim 17 as a whole. Applicants submit that at least for such reasons, that independent claim 17 is neither anticipated, nor is obvious in view of such cited references.

Dependent Claim 18

Dependent claim 18 is a new claim that depends off of new claim 17 and recites, among other features,

... *each edge function* is associated with one particular edge of the graphic primitive and *determines whether or not the next pixel in the horizontal direction is within the graphic primitive with respect to the one particular edge*.

Applicants respectfully reassert the arguments made above regarding Rosman et al., Zhao et al. and Malamy et al., and further submit that, none of the references, either implicitly or explicitly, or whether considered alone, or in combination with any one or more of the other references, disclose, teach or suggest, claim 18's language including, inter alia,

...*each edge function* is associated with one particular edge of the graphic primitive and *determines whether or not the next pixel in the horizontal direction is within the graphic primitive with respect to the one particular edge*,

(claim 18), nor do the references disclose, teach or suggest the subject matter of claim 18 as a whole. Applicants submit that at least for such reasons, that independent claim 18 is neither anticipated, nor is obvious in view of such cited references.

Further, Applicants submit that because claim 18 depends from claim 17, and as a dependent claim therefrom, claim 18 is allowable for at least the reasons claim 17 is allowable. Applicants further submit, argued in part at least immediate above, that claim 18 is also

allowable in light of the presence of novel and non-obvious elements contained in claim 18 that are not otherwise present in claim 17.

Dependent Claim 19

Dependent claim 19 is a new claim that depends off of new claim 17 and recites, among other features, “ ... each edge function returns *a positive result* if the next pixel is within the graphic primitive with respect to the one particular edge.”

Applicants respectfully reassert the arguments made above regarding Rosman et al., Zhao et al. and Malamy et al., and further submit that, none of the references, either implicitly or explicitly, or whether considered alone, or in combination with any one or more of the other references, disclose, teach or suggest, claim 19’s language including, inter alia, “each edge function returns a *positive result* if the next pixel is within the graphic primitive with respect to the one particular edge,” (claim 19), nor do the references disclose, teach or suggest the subject matter of claim 19 as a whole. Applicants submit that at least for such reasons, that independent claim 19 is neither anticipated, nor is obvious in view of such cited references.

Further, Applicants submit that because claim 19 depends from claim 17, and as a dependent claim therefrom, claim 19 is allowable for at least the reasons claim 17 is allowable. Applicants further submit, argued in part at least immediate above, that claim 19 is also allowable in light of the presence of novel and non-obvious elements contained in claim 19 that are not otherwise present in claim 17.

Independent Claim 20

Independent claim 20 is a new claim and recites, among other features,

... *determining, successively, from the representative values of the primitive data values for each pixel of a set of pixels that are inside of the triangle, and, for each current pixel of the set of pixels inside of the triangle, looking ahead to a next adjacent pixel to determined if the next adjacent pixel is inside of the triangle using edge functions;*

storing a characteristic value for the next adjacent pixel when the next adjacent pixel is inside the triangle; and

scanning the current pixel while looking ahead to a next adjacent pixel to determined using edge functions if the next adjacent pixel is inside of the triangle.

Applicants respectfully reassert the arguments made above regarding Rosman et al., Zhao et al. and Malamy et al., and further submit that, none of the references, either implicitly or

explicitly, or whether considered alone, or in combination with any one or more of the other references, disclose, teach or suggest, claim 20's language including, inter alia,

...determining, successively, from the representative values of the primitive data values for each pixel of a set of pixels that are inside of the triangle, and, for each current pixel of the set of pixels inside of the triangle, looking ahead to a next adjacent pixel to be determined if the next adjacent pixel is inside of the triangle using edge functions; storing a characteristic value for the next adjacent pixel when the next adjacent pixel is inside the triangle; and scanning the current pixel while looking ahead to a next adjacent pixel to be determined using edge functions if the next adjacent pixel is inside of the triangle,

(claim 20), nor do the references disclose, teach or suggest the subject matter of claim 20 as a whole. Applicants submit that at least for such reasons, that independent claim 20 is neither anticipated, nor is obvious in view of such cited references.

Independent Claim 21

Independent claim 21 is a new claim and recites, among other features,

... a first module that generates edge functions for the primitive and that provides indication of which of the edge functions corresponds to a longest side of the triangular primitive, and that provides starting coordinates for the triangular primitive;

a second module that forms pixels using the edge functions of the primitive and that provides at least one data value for each pixel; and

a third module that, successively, from a successive current pixel, determines if a next pixel is within the triangular primitive, the third module only storing a data value of the next pixel when the next pixel is inside of the triangular primitive.

Applicants respectfully reassert the arguments made above regarding Rosman et al., Zhao et al. and Malamy et al., and further submit that, none of the references, either implicitly or explicitly, or whether considered alone, or in combination with any one or more of the other references, disclose, teach or suggest, claim 21's language including, inter alia,

...a third module that, successively, from a successive current pixel, determines if a next pixel is within the triangular primitive, the third module only storing a data value of the next pixel when the next pixel is inside of the triangular primitive,

(claim 21), nor do the references disclose, teach or suggest the subject matter of claim 21 as a whole. Applicants submit that at least for such reasons, that independent claim 21 is neither anticipated, nor is obvious in view of such cited references.

Amended Claims 2-5, 10-12 and 14-16

Claims 2-4, 10-12 and 14-16 have been amended to more accurately claim the subject matter that Applicants regard as the invention. Applicants submit that the new language in the amended claims do not include new matter. Further, Applicants submit that since each amended claim depends from one of the new claims identified above, that such dependent claims are allowable, at least for the reasons discussed above as to why the corresponding independent claim is allowable.

Further, Applicants submit that claims 2-4, 10-12 and 14-16 are allowable at least because, as amended, or as such claims now depend from a claim now newly amended, or because of Applicants' arguments highlighting the explicit and inherent differences between Applicants' claimed subject matter and that disclosed by the references, that the claimed subject matter therein is neither anticipated, nor is it obvious, in light of any reference alone, nor any combination thereof. As such, Applicants also request the removal of the pending rejections and the allowance of each of the claims.

Claim 5 continues to depend from claim 4. Applicants submit that because claim 5 depends from claim 4, and as a dependent claim therefrom, claim 5 is allowable for at least the reasons claim 4 is allowable. Applicants further submit, argued in part at least immediately above, that claim 5 is also allowable in light of the presence of novel and non-obvious elements contained in claim 5 that are not otherwise present in claim 4.


CONCLUSION

For the foregoing reasons, withdrawal of the rejections and allowance of the claims is respectfully requested. If there are any questions or comments regarding this response, the Examiner is encouraged to contact the undersigned at 312-609-7500.

Respectfully submitted,

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Vedder, Price, Kaufman & Kammholz
222 North LaSalle Street
Chicago, Illinois 60601
Telephone: (312) 609-7500
Facsimile: (312) 609-5005

By: 
Brent A. Boyd
Reg. No. 51,020